MARKED-UP CLAIMS:

1. An aerosol time-of-flight mass spectrometer comprising:

an elongated sealed vacuum chamber having an axial direction with a central longitudinal axis, said elongated sealed vacuum chamber having an input side and an opposite side, said input side having at least two inlet ports for admission to said elongated sealed high-vacuum chamber of at least two flows of charged particles of a substance to fly through said elongated sealed vacuum chamber simultaneously and independently of each other;

electrostatic field generation means for generating an electrostatic field in said an elongated sealed vacuum chamber for causing charged particles that entered said elongated sealed high-vacuum chamber through said at least two inlet ports to fly along different curvilinear trajectories in a direct path from said input side towards said opposite side and in a return path from said opposite side to said input side; and

a charged particle detector means for detecting ~~positions~~times of collisions of said charged particles with said charged particle detector means for determining the time of flight of said charged particles independently for each of said at least two flows, said charged particle detector means being located in the vicinity of said at least two inlet ports and generating collision signals at the moments of said collisions.

2. The aerosol time-of-flight mass spectrometer according to Claim 1, wherein said electrostatic field generation means comprise:

a plurality of quadrupole electrostatic lenses which are arranged in series and coaxially in said direction from said input side to said opposite side, each of said

quadrupole electrostatic lenses comprising a circular body formed by four arch-shaped poles located substantially in a common plane perpendicular to said central longitudinal axis and arranged circumferentially about said central longitudinal axis in the form of a first pair composed of two diametrically opposite and electrically connected poles and a second pair composed of two diametrically opposite and electrically connected poles, in each of said quadrupole electrostatic lenses said poles being angularly shifted with respect to said poles of a quadrupole electrostatic lens subsequent in said direct path by a selected angle in order to provide said angular gradient of the electrostatic field between adjacent quadrupole lenses of said plurality and thus to cause said charged particles to move along said curvilinear trajectories; and

mirror means comprising: an electrostatic mirror located on said opposite side for reflecting said charged particles in a return direction opposite to said direction from said input side to said opposite side for dividing said ~~helical~~curvilinear trajectories into a direct section for movement of said charged particles in said direction from said input side to said opposite side and a return section for movement of said charged particles in a direction from said opposite side to said input side.

5. The aerosol time-of-flight mass spectrometer according to ~~Claim 1~~Claim 4, wherein said flow deflection unit comprises a first electrode plate and a second electrode plate spaced from said first electrode plate, said first electrode plate being connected to a first power supply that provides deflection of said single flow of charged particles by an angle α towards one of said at least two inlet ports, said second electrode plate being connected to a second power supply via a switching unit that provides deflection of said

single flow of charged particles by an angle 2α towards another of said at least two inlet ports.

~~14~~15. The aerosol time-of-flight mass spectrometer according to Claim 2, wherein said charged particle detector means comprise a first micro-channel plate detector which is aligned with one of said at least two inlet ports and a second micro-channel plate detector which is aligned with another of said at least two inlet ports, said first micro-channel plate detector having an opening aligned with said one of said two inlet ports for passing one of said at least two charged particles flows into said elongated sealed high-vacuum chamber, and said second micro-channel plate detector having an opening aligned with the other of said two inlet ports for passing the other of said at least two charged particles flows into said elongated sealed high-vacuum chamber.

23. The aerosol time-of-flight mass spectrometer according to Claim 14, wherein said ~~electrostatic~~mirror means comprise at least one electrostatic mirror coaxial with said quadrupole electrostatic lenses and located after the last quadrupole electrostatic lens in said charged particle propagation direction.

28. A method of mass spectrometry with the use of an aerosol time-of-flight mass spectrometer that receives a flow of charged particles for analysis, said mass spectrometer having an input side and an opposite side opposite to said input side, particle collision detection means on said input side, and data acquisition and processing means, said method comprising the steps of:

dividing said flow of charged particles into at least two flows of charged particles;

subjecting said charged particles in said at least two flows to random pulse modulation for generating irregular sequence of said charged particles in said at least two flows;

generating an electrostatic ~~magnetic~~field in said mass spectrometer for directing said charged particles of said at least two flows along at least two predetermined non-linear trajectories in a direct path from said input side to said opposite side and reflecting said charged particles in a return path from said opposite side to said input side;

detecting ~~points~~times of collision of said charged particles with said particle collision detection means independently for particles of each of said at last two flows;

generating and measuring collision detection signals that result from said collision independently for charged particles of each of said at least two flows and analyzing mass distribution of said charged particles of each of said at least two flows on the basis of said collision detection signals.